REMARKS/ARGUMENTS

Claims 1-20 are currently amended.

Claims 8-11 and 17-20 are withdrawn.

Claim 21 is added.

Support for the amendments to Claim 2 is found at page 4, lines 18-27.

Support for Claim 21 is also found at page 4, lines 18-27.

The amendments to the Claims improve readability and correct a minor typographical error.

Support for the amendment replacing "rising angle" with "pre-tilt angle" is found at page 5, line 27.

The amendments to the specification correct minor typographical and clerical errors.

No new matter is added.

Claims 1-7, 12-16 and 21 are active.

The rejection of Claims 1-7 and 12-16 under 35 U.S.C. §102(b) over Kim (US 6,091,471) is respectfully traversed.

Claim 1 is directed to a liquid crystal display device comprising a pair of substrates, at least one of which is transparent; a liquid crystal layer between the pair of substrates; a group of electrodes formed on at least one of the substrates and adapted to apply an electric field to said liquid crystal layer, wherein the electric field has a component substantially parallel to the surfaces of the substrates; and an alignment layer disposed between the liquid crystal layer and at least one of the substrates, wherein the alignment layer has been subjected to liquid crystal anchoring treatments in plural directions to form a plurality of liquid crystal in-plane anchoring directions, the plurality of liquid crystal in-plane anchoring directions of the alignment layer form substantially equal angles relative to one another on the corresponding

substrate surface, a pretilt angle in each of the liquid crystal anchoring direction with respect to the corresponding substrate surface is substantially zero.

Applicants note that even when the in-plane anchoring directions form substantially equal angles relative to one another, when anchoring force is provided to the alignment layer through rubbing treatment, the alignment direction has a pre-tilt angle with respect to the substrate surface and breaking of symmetry due to the pre-tilt angle must be considered as well (see page 7, lines 1-11). Applicants direct the Office's attention to Figure 1(c) of the present application, which shows perpendicular in-plane alignment directions which both have pre-tilt angles not substantially equal to zero. Applicants clearly describe that such configuration is not desired (see page 7, lines 12-23).

Kim describes a method of manufacturing an LC cell having two substrates, which in turn have alignment layers on each substrate and a liquid crystal layer between the two substrates (see Abstract). Office asserts that electrodes are inherently disclosed in col. 6, lines 32-34 as in-plane switching behavior is described (see col. 6, lines 32-34). The alignment layers are treated in various ways so that the pre-tilt angles can be less than 5° or more than 60° (see col. 1, lines 32-36).

Specifically, Figures 11 and 12 show two alignment directions on substrate 2 which have high pretilt angles (note the standing up lines on the substrate indicating high pretilt angles). Figure 13 shows substrates 1 and 2 having high and low pretilt angles. Figure 14 describes a process for fabricating a four-domain liquid crystal cell by rubbing (which the Applicants have already mentioned as being problematic), wherein the anchoring directions of the alignment layer form an angle of about 90°. Note that Kim describes the reverse rubbing treatment (see col. 1, line 66 – col. 2, line 20) in Figure 1, which shows alignment layers having high pretilt angles. Therefore, Kim fails to describe or suggest the importance

of the pre-tilt angles being substantially zero in each of the plurality of in-plane alignment directions as claimed in claim 1.

Applicants submit that Kim fails to describe or suggest a liquid crystal device wherein the pretilt angle in each of the plurality of liquid crystal anchoring direction with respect to the corresponding substrate surface is substantially zero.

Claim 2 is directed to a liquid crystal display device comprising a pair of substrates, at least one of which is transparent; a liquid crystal layer between the pair of substrates; a group of electrodes formed on at least one of the substrates and adapted to apply an electric field to the liquid crystal layer, the electric field having component substantially parallel to the surfaces of the substrates; and an alignment layer disposed between the liquid crystal layer and at least one of the substrates wherein the alignment layer has been subjected to liquid crystal anchoring treatments in two directions to form two liquid crystal in-plane anchoring directions; the two liquid crystal in-plane anchoring directions of the alignment layer form an angle of about 90° relative to each other on the corresponding substrate surface; a pretilt angle in one liquid crystal anchoring direction with respect to the corresponding substrate surface is substantially zero, a pretilt angle in the other liquid crystal anchoring direction with respect to the corresponding substrate surface is not substantially zero; and the device is capable of maintaining two stable in-plane alignment states of the liquid crystal layer even after the removal of the applied electric field.

However, Applicants submit that Kim fails to describe or suggest a device wherein the device is capable of maintaining a plurality of stable in-plane alignment states of the liquid crystal layer even after the removal of the applied electric field, as presently claimed.

For example, Figure 14a-14c in Kim describes the production of a four-domain alignment layer by rubbing in reverse directions on the first substrate (see col. 8, lines 42-45). Figure 14d-14i describes the production of a four-domain alignment by changing the photo-

irradiating directions on the second substrate (see col. 8, lines 45-47). These two substrates are combined to obtain a device shown in Figure 14j. However, the device shown in Figure 14g cannot maintain stable in-plane alignment states after the removal of the applied voltage. Notably, only the in-plane twisted nematic structure ("on" state) is stable after the removal of an applied voltage. To remove the selective reflection of color in the "on" state, a continuous application of electric field perpendicular to the substrates (as one example) would be necessary.

The present invention, however, allows a plurality of in-plane stable alignment states to exist even after the removal of the applied electric field. For example, Figure 5 of the present application shows an example of a device where two stable states, an "on" (Figure 5b) state and an "off" (Figure 5a) state, can be maintained without the application of a voltage. Such plurality of in-plane stable alignment states after the removal of an applied electric field is neither disclosed nor suggested by Kim.

Note the significant advantage of lowered power consumption afforded by the present invention. Once the applied electric field is removed, no further power consumption occurs, offering a liquid crystal device with lowered power consumption. Clearly, superior results are demonstrated by the present invention.

Claim 21 is also directed to a device capable of maintaining a plurality of stable in-plane alignment states of the liquid crystal layer even after the removal of the applied electric field, as presently claimed. Therefore, Claim 21 is also allowable.

Therefore, withdrawal of the rejection is requested.

Claims 3-21, which are dependent on allowable Claim 1 and 2, are also directed to allowable subject matter.

Applicants submit the application is now in condition for allowance. Early notification of such allowance is earnestly solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.
Norman F. Oblon

Richard L. Treanor
Registration No. 36,379

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 06/04)